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17 March 1966

PURCHASE DESCRIPTION

FOR

CAMMA I RECTIFIERS

I. This specification modifies and expands the previous GAMMA I specification dated 10 April 1963.

A. Input Specifications

1. Focal length - 24 inches
2. Film length - 500 feet
3. Film width - 70mm (58 mm format)
4. Scan angle (primary) - 70°
5. Roll range - ± 5°
6. Primary tilt angle - 15°
7. Primary tilt range - ±5°
8. Maximum input resolution - 200 lines per millimeter
9. Format and fiducial orientation - (to be supplied)
10. Camera altitude - variable (to be supplied)

B. Output Specifications

1. Format size - full format (not segmented) on 9 1/2 inch wide film. The easel shall accommodate full format with ±5° roll.
2. Optimum Output Scale - 1.875x magnification at center of format.
3. Auxiliary data to be recorded - the data block contained on the input format shall be printed to the same scale as the format image.

C. Earth Curvature - Shall be compensated for by an adjustable radius easel with sufficient range to permit the easel radius to change continuously from 47 feet to 126 feet. All adjustments shall be calibrated for convenient settings with direct right reading dials.

D. Focus Cam - A multiple wafer fine focus lens cam shall be provided which will adjust the lens to provide the required lens conjugated for optimum focus thru the full sweep range and compensate for the change in projection distance resulting from the adjustable easel. The ratio of cam to lens shall be allowable maximum and shall cover the full range of earth curvature variables.

E. Primary Tilt Range - 0° & through the range of +10° to +20°.

F. Total Tilt Range - -5 degrees to +20 degrees. The equipment shall accommodate this total tilt range, but the resolution requirements (80 to 50 1/mm) and accuracy requirements (0.010 inch at the easel) shall apply only within the primary tilt range (0° and through the range of +10° to 20°).

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G. Roll - Easel length and input format shall be based on ±5 degrees roll to produce the full print, however, the fiducial offset will accommodate ±10 degrees roll.

H. Resolution - The resolution capability shall be a minimum of 80 lines/mm at nadir across the width of the format and no less that 50 lines/mm at any point on the format. These values are referred to the negative scale and printed on duplicating film (5427 or 228R). The resolving capability shall apply for any setting of the easel tilt of 0^{o} and through the range of 10^{o} to 20^{o} combined with any setting of the easel curvature. The design goal should be to maintain the greatest resolution value over the entire series of minimum nominal and maximum, from 0^{o} to 20^{o}.

I. Accuracy - The accuracy of the output shall be 0.010 inch and shall approach a design goal of 0.005 inch with no error greater than 0.010 inch. The accuracy of the printer shall be tested with constructed grids to duplicate taking case pitched panoramic displacements. These grids are to be supplied by the contracting agency. The projection of the grids through the rectifier with the proper settings shall be measured and compared with the true rectified positions.

J. Film Support (Input Format) - Rollers or other suitable means shall be provided to support the input film in its proper plane at the exposure point throughout the entire 70^{o} sweep range. A convenient method for adjusting rollers will be incorporated.

K. Orientation of Input Film - A means of aligning the input fiducial coincident with the rectifier optical axis shall be provided. A positive calibrated means shall be provided for displacing this reference mark by $\pm 10^{o}$ from the rectifier optical axis.

L. Variable Magnification - The equipment shall possess a means for displacing the easel from its optimum focus position by a measured amount sufficient to alter the output scale by ±1%. This displacement may be either in the plus or minus direction from the optimum focus position; however, the resolution specified under "Resolution" shall apply only at the optimum focus position. The means to make this determination shall be a right reading dial and shall be computed in the "Table of Settings". (A Table of Primary Settings will be provided in addition to the slide rule.)

M. Negative Transport - Manual - The film transport system (i.e., rollers, platen) shall be designed to prevent damage (i.e. scratches, abrasions) to the 70 mm input film. The capacity shall be 500 feet. Means shall be provided to relieve the pressure on the rubber drive roller in such a manner as to insure repeatable and constant pressure on the drive roller upon replacement.

N. Copy Transport - Automatic - The film transport system shall be designed to prevent damage to the output film or paper. The easel flanges shall accommodate 9 3/8" or 9 1/2" film or paper. A Light-Tight means (cassettes) with a capacity for 500 ft. spools shall be provided at each end of easel.

O. Exposure Control - An automatic means shall be provided for controlling the exposure during sweep to compensate for the changing projection distance.

P. Light Source - The light source and condensing system shall provide sufficient illumination at the input negative to allow exposure times to be in the optimum range (10 to 60 seconds) when printing from negatives with density ranges varying from 0.2 to 1.4. A rheostat shall be provided with a range from 20% of lamp rated voltage to 110% of lamp rated voltage with continuous illumination. The rheostat will have a fixed position that will indicate the rated voltage of the lamp. The lamp head shall be provided with convenient adjustments to allow the operator to align the lamp filament in its proper relationship to the condensing lens system. A method or means (possibly in the form of a small screen which would snap onto the bottom of the condensing lens) shall be provided to assist the operator in this alignment. A scale or vernier to facilitate the setting of the slit opening shall be provided.

Q. Table of Settings - A table of computed primary settings to assist the operator in determining displacements, angles, scale and other required instrument settings will be provided in addition to the slide rule. Six copies shall be furnished.

R. Life Requirements - The Rectifier, Gamma I, shall be capable of operation for 16 hours per day for 60 consecutive days without a failure requiring more than two hours for repair, which frequency of failure shall not exceed an average of one per week. Normal preventive maintenance of one-half hour per day shall not be considered a part of the failure time.

II. INSTRUCTION MANUALS - 4 copies of operator and maintenance manuals

III. ENGINEERING DRAWINGS AND SPECIFICATION DATA completely depicting the design, fabrication and installation of Item 1. The drawing set shall consist of a drawing list, main assembly drawing, assembly drawings for each assembly and sub-assembly and a drawing for each detail part. Complete schematic diagrams shall be furnished when electrical or electronic circuits are employed. Materials shall be identified by their common trade names, grade, type and condition as applicable. All commercial parts shall be identified by the manufacturer's name and identifying number. Drawing of commercial standard parts and hardware need not be supplied. Processes and techniques developed specifically for this equipment shall be described by drawings or specifications. The drawings shall be prepared on the contractor's own drawing forms (printed format). All drawings shall be listed on a numerical index 8 1/2 inches by 11 inches. The indexes shall include the [illegible] nature of the

equipment. When the equipment is complex, a master index and an index of each major component shall be supplied. The drawings shall include all revisions resulting from inspection and tests of the equipment, and shall conform to the equipment as accepted. Workmanship shall be of high quality in accordance with good engineering drafting practices. Freehand sketches will not be accepted. The drawings and data shall be microfilm copies in accordance with Exhibit RADC-3003A entitled: "Microfilm, Aperture, and Tabulating Cards for Engineering Drawings Requirements For," dated 16 February 1961.

A. It is not the intent of any contractual document or specification that each and every drawing of the set described above be classified in accordance with the security classification of the equipment; rather, it is intended that only those drawings which specifically divulge classified information be marked with the appropriate security classification. Further instruction should be obtained on all doubtful classification.

IV. PRELIMINARY AND FINAL ACCEPTANCE TESTS

A. General - An acceptance test will be conducted at the Contractor's facilities on the Rectifier prior to shipment to the receiving agency. The test will determine resolution, accuracy and reliability of the equipment and whether these factors meet the required specifications. The following specifications must be met and acceptable at 0^{o} and through the range of $+10^{o}$ to $+20^{o}$ tilt.

1. Resolution -- The instrument must resolve a minimum of 80 lines per millimeter across the width of the format at the center and no less than 50 lines per mm at any point on the format. The resolving capability must apply for settings of the easel tilt at 0^{o} and through the range $+10^{o}$ to $+20^{o}$ combined with any setting of the easel curvature.

2. Accuracy - The error in the output when referred to true computer position shall not be greater than 0.010 inches and shall approach design goal of 0.005 inches.

3. Reliability - The instrument shall operate properly for a period of 16 hours without malfunction of any of the parts.

B. Resolution Test - A high contrast resolution target in excess of 200 lines per millimeter covering the entire format of the instrument will be projected through each of the tilt angles -5^{o}, 0^{o}, $+5^{o}$, $+10^{o}$, $+15^{o}$, and $+20^{o}$ at optimum magnification and for each of these tilt angles at minimum, middle and maximum settings of the easel curvature.

The resolution targets shall be projected onto Kodak Aerographic Duplicating Film Type 5427 and processed in accordance with manufacturer's instructions. Each of the projected resolution targets shall be read to determine the actual resolution obtainable according to Mil-Std-150A which prescribed the resulting point resolution as a geometric average between the vertical and horizontal targets. A resolution target will be projected at $+15^{\circ}$ easel tilt using the middle setting for easel curvature and +0.10 inches, +0.05 inches, -0.05 inches and -0.10 inches from the optimum magnification setting. These projected targets will also be checked in the same manner for actual resolutions.

C. Accuracy Tests - A square calibrated grid of 45 points will be projected through each of the same tilt angles as in the resolution test for the minimum, middle and maximum settings of the easel curvature. The same tests will be repeated two (2) additional times except for the -5° and $+5^{\circ}$ tilt settings. The film on which the grid will be projected should be a polyester base film. The projected grids after processing will be measured and compared against the true mathematically projected values.

D. Reliability Test - The instrument shall be tested for reliability by operating 16 hours without malfunction of any of the individual operating parts.

E. Evaluation of Tests - The projected resolution targets and grids will be read and/or measured as required at the Contractor's facilities, if possible, and will be measured at the Army Map Service (AMS) after completion of the test. The mathematical projections of the grids, resulting accuracy determination and resolution determinations will be made at AMS.

F. Mechanical Check List - The parts of the instrument that will be checked for proper operation:

1. Sweeping light source
2. Platen movement
3. Ways on which the platen is supported
4. Lens and cam assemblies (Scheimpflug + Gamma)

V. INSTALLATION - The contractor shall install and calibrate the two instruments at AMS.

VI. CONTRACT STATUS REPORT - Three copies of a contract status report shall be prepared in letter form. The contract status report shall include at least the following:

A. A summary of the work performed during the reporting period.

B. Conformance or nonconformance to projected work schedule.

C. An analysis of work progress covering the reporting period.

D. A short statement of work effort planned for the next reporting period.

E. A statement describing significant changes in the contractor's operating personnel.

21 March 1966

Addendum to the

PURCHASE DESCRIPTION FOR GAMMA I RECTIFIERS

This addendum modifies the previous Gamma I purchase description dated 17 March 1966 and entitled "Purchase Description for Gamma I Rectifier" to include an extended altitude range not previously considered. These paragraphs of the purchase description that require modification are revised as follows:

Paragraph I-C Earth Curvature

Earth Curvature shall be compensated for by an adjustable radius easel with sufficient range to permit the easel radius to change continuously from 47 feet to infinity (flat easel). The usable range of the easel will be from 47 feet to 126 feet and at a single radius of approximately 900 feet. All adjustments shall be calibrated for convenient settings with direct reading dials.

Paragraph I-D Focus Cam

A multiple wafer fine focus lens cam shall be provided which will adjust the lens to provide the required lens conjugate for optimum focus through the full sweep range and compensate for the change in projection distance resulting from the adjustable easel throughout those ranges listed in paragraph I-C entitled Earth Curvature.

Paragraph I-H Resolution

The resolution capability shall be a minimum of 80 lines/mm at nadir across the width of the format and no less than 50 lines/mm at any point on the format. These values are referred to the negative scale and printed on duplicating film (5427 or 228R). The resolving capability shall apply for any setting of the easel tilt 0° and through the range of 10° to 20° combined with settings of the easel curvature as listed in paragraph I-C entitled Earth Curvature. The design goal should be to maintain the greatest resolution value over the entire series of minimum nominal and maximum, from 0° to 20°.

Paragraph IV-A.1 Resolution

The instrument must resolve a minimum of 80 lines per millimeter across the width of the format at the center and no less than 50 lines per mm at any point on the format. The resolving capability must apply for settings of the easel tilt at 0^{o} and through the range of $+10^{o}$ to $+20^{o}$ combined with settings of the easel curvature as listed in paragraph I-C entitled Earth Curvature.

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